

- Fig. 2. *Palasterina primæva*, Forbes. Upper Silurian (Lower Ludlow rock). Church Hill, Leintwardine, Shropshire: *b* is a cast of the lower surface; *c*, portion of ditto, magnified, showing the large adambulacrals and their basal ossicles (\*).
- Fig. 3. *Palæocoma Marstoni*, n. sp. Same locality: 3 *b*, somewhat magnified; 3 *c* shows the narrow ambulacral rows, the broad smooth adambulacrals, and the outer spine-bearing rows.
- Fig. 4. *Protaster Miltoni*, n. sp. Same locality: 4 *a*, nat. size; 4 *b*, upper plates magnified; 4 *c*, lower surface with the large pores.
- Fig. 5. *Protaster leptosoma*, n. sp. Same locality.
- Fig. 6. *Palæodiscus ferox*, n. sp. Same locality.
- Fig. 7. Section of arm of *Protaster*, for comparison with *Ophiura* (fig. 8). It shows the six component plates.
- Fig. 8. Section of the arm of *Ophiura*, to show the four component plates and the passage for the suckers.

XXXI.—*Observations on the Habits of various Marine Animals.*

By Madame JEANNETTE POWER †.

*On the Food and Digestion of the Bulla lignaria.*

FROM 1832 to 1842 I was engaged in studying marine animals in aquaria established in my house at Messina. These aquaria were filled with sea-water, and about 1832 I gave them the name of ‘cages †.’ In 1833 I invented other aquaria, which I also called ‘cages’ §; these I deposited (after obtaining permission from government) in a stream of sea-water which flows through the lazaretto of Messina.

Marine animals of large and moderate dimensions being thus kept in their native element, were in a better condition for my investigations than in the aquaria placed in my house; and as the sea which washes the coast of Sicily is very limpid and transparent, I was enabled to observe the least movements of my animals minutely and exactly.

The smaller marine animals I continued to study in my own house; and I had also invented a small glass aquarium, which I suspended by means of cords in a large ‘cage’ in the sea.

After publishing memoirs upon *Argonauta Argo* and other marine animals, I proposed to continue my publications; but, unfortunately, in the confusion of packing-up, preparatory to my departure from Sicily, my manuscripts were mislaid, and I

† Communicated by Prof. Owen.

‡ See the Journal of the “Cabinet littéraire de l’Académie Gioenia de Catania” for December 1834, in which Professor Carmelo Maravigna gives an account of the investigations which I made upon *Argonauta Argo*, in my own house at Messina.

§ In 1835 these cages received from the Académie Gioenia the name of ‘Gabiote alla Power,’ and in 1838 the Zoological Society of London called them ‘Power cages.’

have only just discovered them amongst some old papers; I therefore hasten to lay the following observations before you.

Having procured several living specimens of *Bulla lignaria*, I opened their digestive sacs, to ascertain what their nourishment consisted of; in almost all I found small specimens of *Dentalium entale*. I then set myself to investigate the mode and the time which they employ to digest the *Dentalia*.

On the 15th July 1836 I placed some specimens of *Bulla lignaria* in a 'cage,' without providing them with food, and on the 16th I placed close to my *Bullæ* a quantity of *Dentalia*; when, by not losing sight of the *Bullæ*, I saw that they devoured the *Dentalia*. An hour after their repast, I took one of them, opened its digestive sac carefully, and found in the alimentary canal, extending in a straight line from the mouth to the orifice of the digestive sac, five *Dentalia* placed side by side, and their points were already digested for a distance of 2 millimetres in length. The digestive sac of the *Bulla* consists of two very hard pieces, supported by membranous and elastic ligaments, which allow the movement of trituration, and this acting from right to left, and facilitated by the gastric juice, reduced the *Dentalia* into a nutritive pulp; they slip by little and little and altogether into the sac, in proportion as the animal triturates them. This is the only food of the *Bulla lignaria*.

Two hours after my first observation, I took a second *Bulla*: its alimentary canal only contained four *Dentalia*, which were more than half digested. Two hours afterwards I took a third: of six *Dentalia* which it had in its alimentary canal, there only remained a length of 3 millimetres. The last that I opened had employed seven hours in its digestion.

From the observations which I have made, I have ascertained that some *Bullæ* digest more rapidly than others.

#### *On the Nourishment and Digestion of the Asterias (Astropecten) aurantiacus.*

On the 20th July 1836, I placed three large specimens of *Asterias* in a 'cage,' and left them until the 23rd, without giving them any food; I weighed them, noted their weight, then put them again in the cage, and placed within their reach a quantity of living *Natica* of various dimensions, and some *Trochi*. The *Asterias* feeds only upon these mollusks.

The mode in which it swallows and arranges them in the interior of its rays and body is very curious. It commences by seizing a small *Natica* with the point of each of its rays, and then brings it gradually up to the body, which is of a spherical form; it places on, or beneath the body a circular row, and then

a second of rather larger size, and so on, finishing in the centre with a very large one; after this it buries itself in the sand, and remains quiet to digest its food, employing in this function two or three days, and sometimes more. I weighed my Star-fishes again after their repast: one of them had swallowed 370 grms. of *Natica*, the second 256, and the third 240.

They have the habit of coming out of the sand early in the morning, hide themselves about nine o'clock, and reappear about four in the afternoon, when the heat of the sun begins to diminish.

*Observations upon Octopus vulgaris and Pinna nobilis.*

Into one of my cages I had put a living *Pinna nobilis* adhering to a fragment of rock; this cage also contained an *Octopus vulgaris* and some living testaceous Mollusca which I had placed there for the purpose of my investigations.

One day, whilst observing my animals, I saw that the Poulpe was holding a fragment of rock in one of its arms, and watching the *Pinna*, which was opening its valves; as soon as they were perfectly open, the Poulpe, with incredible address and promptitude, placed the stone between the valves, preventing the *Pinna* from closing them again, when the *Octopus* set about devouring the mollusk.

The next day I was observing the Poulpe again, when I saw him crush some *Tellinæ*, then search about amongst other shells, and finally stretch himself close to a *Triton nodiferum*. I had the perseverance to remain on the watch for four hours. The *Triton* extruded half the body from its shell, no doubt with the purpose of going to seek its food, when the Poulpe sprang upon it, and surrounded it with his arms; the mollusk retired precipitately into its shell, and in closing this with its operculum pinched the point of one of the arms of the Poulpe, which, by struggling, at last left the tip of his arm in the shell of the *Triton*.

It would require whole pages to describe all the stratagems employed by the Poulpe for the capture of his prey. I should have to tell things which would appear incredible; and his voracity is such, that notwithstanding the abundance of nourishment with which I furnished him, I was compelled to remove him from the cage, or he would have devoured all my Mollusca.

I would beg Professor Costa and others who occupy themselves with this branch of science to repeat my experiments in their aquaria; they are of the greatest interest in the appreciation of the habits of this animal. So great is its voracity, that it even attacks man, tears away his flesh, and eats it. In the Port of Messina they occur in great numbers and of large size.